NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech.(ICE)		
Course Title	DATA STRUCTURES AND ALGORITHMS		
Course Code	ICPE53	No. of Credits	3
Course Code of Pre-requisite subject(s)	NIL		
Session	July 2023	Section (if, applicable)	A and B
Name of Faculty	MICHAEL AROCK	Department	Computer Applications
Official Email	michael@nitt.edu	Telephone No.	0431-2503736
Name of Course Coordinator(s) (if, applicable)	N.A.		
Official E-mail		Telephone No.	
Course Type (please tick appropriately)	Programme Elective course		

Syllabus (approved in BoS)

Introduction to problem solving, Mathematical preliminaries, Growth of functions, time complexity and space complexity, worst-case and average-case analyses, use of order notations and related results, recurrence relations: substitution method, recurrence trees, Master's theorem and its applications.

Insertion-Sort, Divide & Conquer Strategy and Merge-Sort, Heap-sort, Quick-sort, Randomized versions of Quick-sort, sorting in linear time,

Elementary data structures (Arrays, Stacks, Queues, Linked Lists), Hash tables, Binary search trees, Advanced data structures: B-Trees, Fibonacci heaps, Data structures for disjoint sets (for applications in control system design).

Dynamic Programming, Greedy Algorithms, B-Trees, Elementary Graph Algorithms, Arithmetic Circuits, Matrix Operations, Linear Programming, Polynomials & FFT, Number Theoretic Algorithms

Advanced Topics – NP-Completeness, Approximation Algorithms, Randomized Algorithms, Applications in Engineering – Control Systems, VLSI Design, etc.

Text Books:

1. Cormen TH, Leiserson CE, \& Rivest RL, Introduction to Algorithms, 3rd Edition, Prentice Hall of India. (This book is popularly called as C-L-R)

2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, —Fundamentals of Computer Algorithms||,

Second Edition, Universities Press, 2008.

3. Kenneth A. Berman and Jerome L. Paul, Algorithms, Cengage Learning India, 2010.

4. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, —The Design and Analysis of Computer Algorithms||, First Edition, Pearson Education, 2006.

5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press, PHI, 2021

COURSE OBJECTIVES

- To introduce first level topics covering basics in Algorithms and Data Structures
- To provide examples for various design paradigms
- To identify the basic properties of graphs and trees and model simple applications

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Use linear and nonlinear data structures to solve real-time problems	3,5
2. Apply basic searching and sorting techniques in different application domains	5
3. Use design strategies to solve complex problems	3

COURSE PLAN – PART II

COURSE OVERVIEW

Introduction to problem solving, Elementary data structures (Arrays, Stacks, Queues, Linked Lists), Hash tables, Binary search trees, Advanced data structures: B-Trees, Fibonacci heaps, Data structures for disjoint sets (for applications in control system design).

Mathematical preliminaries, Growth of functions, time complexity and space complexity, worst-case and average-case analyses, use of order notations and related results, recurrence relations: substitution method, recurrence trees, Master's theorem and its applications.

Insertion-Sort, Divide & Conquer Strategy and Merge-Sort, Heap-sort, Quick-sort, Randomized versions of Quick-sort, sorting in linear time,

Dynamic Programming, Greedy Algorithms, Elementary Graph Algorithms, Arithmetic Circuits, Matrix Operations, Linear Programming, Polynomials & FFT, Number Theoretic Algorithms

Advanced Topics – NP-Completeness, Approximation Algorithms, Randomized Algorithms, Applications

in Engineering – Control Systems, VLSI Design, etc.			
COURSE TEACHING AND LEARNING ACTIVITIES			(Add more rows)
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	Week 1	Problem solving and Elementary Data Structures	PPT with C&T
2	Week 2	Stacks, Queues and LLs	PPT with C&T
3	Week 3	BSTs, B-trees, Disjoint Sets	PPT with C&T
4	Week 4	Time complexity Analyses with Asymptotic notations	PPT with C&T
5	Week 5	Recurrence relations with three methods to solve them	PPT with C&T
6	Week 7	Sorting Techniques - I	PPT with C&T
7	Week 8	Sorting Techniques - II	PPT with C&T
8	Week 9	Dynamic Programming, Greedy Algorithms	PPT with C&T
9	Week 11	Elementary Graph Algorithms, Arithmetic Circuits	PPT with C&T
10	Week 12	Matrix Operations, Linear Programming	PPT with C&T
11	Week 14	Polynomials & FFT, Number Theoretic Algorithms	PPT with C&T

12	Week 15	NP-Completeness, Approximation Algorithms, Randomized Algorithms, Applications of DS and Algo.s in Engg.	PPT with C&T

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Asessment - 1	6	1 hour	20
2	Asessment – 2	10	1 hour	20
3	Assignment	13	Within stipulated time	20
CPA	Compensation Assessment*	15	1 hour	20
4	Final Assessment *	18	3 hours	40

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Students' feedback through class committee meetings
2. Feedbacks are collected before final examination through MIS or any other standard format followed by the institute.
3. Students, through their Class Representatives, may give their feedback at any time to the course faculty which will be duly addressed.

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDENCE: By Email: michael@nitt.edu / in-person : Lyceum Room No:120 (GF)

Minimum passing marks: 35% or class_avg/2 (whichever is greater)

COMPENSATION ASSESSMENT POLICY :
One compensation assessment will be conducted for absentees in assessments (other than final assessment) only after the submission of medical or On-Duty certificates signed by competent authority.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.